Efficiency as a means to address India's vulnerability to electricity shortages: A case study

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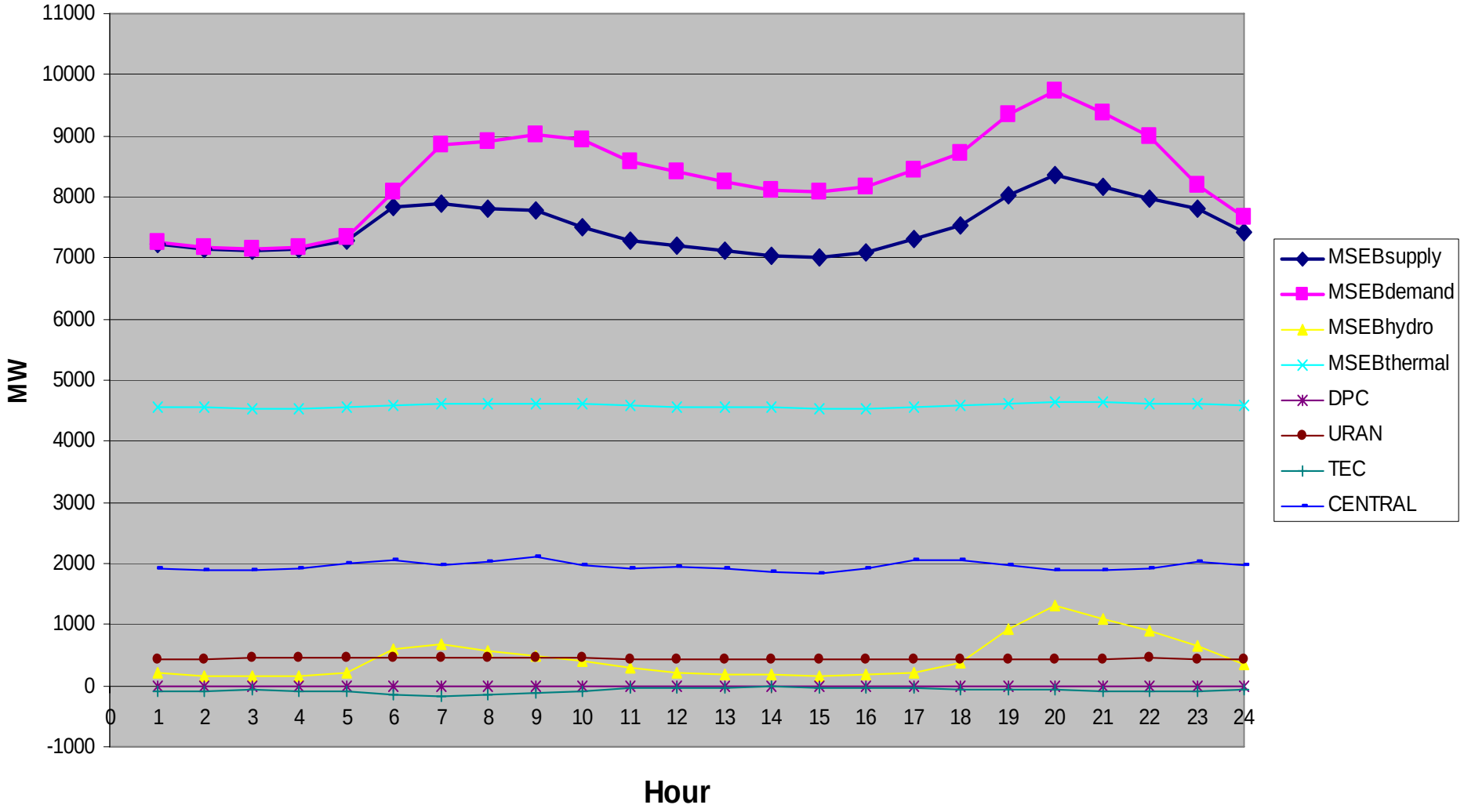
Contents

India Electricity Sector: Background

- **Consumption -- 400 kWh per capita (2004-05)**
  - **Industrial – 35.6%**
  - **Residential -- 24.8%, and commercial -- 8.1%,**
  - **Agricultural – 22.9%**
- **Continued deficit supply:**
  - **Peak power deficit 11.6% and Energy deficit 8 % in 2004-05**
- **Severe aggregate technical and commercial T&D loss**
  - **About 50% in 2004-05**
  - **Assuming 25% technical loss -- 100 billion kWh or about $6 billion a year**
- **Five year plan targets have not been met:**
  - **9th Plan (1997-'02)**
    - **Target -- 40,245 MW new capacity, realized addition was about 21,000 MW**
    - **Private sector target: 17,589 MW, realized addition of 6,735 MW**
  - **10th plan (2002-'07)**
    - **Target 41,010 MW, revised down to 36,956 MW, commissioned: 13,.416 MW**
- **Deficits likely to continue in the near term**

Maharashtra State Electricity Board (MSEB)
Capacity Deficit – Annual average (2002-03)
(7836 GWh load shedding over 20 hours a day;
1376 MW average evening peak load shedding)



State subsidy and cross subsidy for domestic (residential) and agricultural sectors

MSEB: Electricity Tariff and Consumption by Category (2002-03)

Average cost of electricity supply: 6.7 cents/kWh

Type of consumption	Consumption (GWh)	Percentage
Domestic (6 cents/kWh)	7,411	19.1
Commercial (9 cents/kWh)	1,643	4.2
Industrial (6.7 cents/kWh)	15,593	40.3
Railways	1,012	2.6
Public Lighting	576	1.5
Agriculture (< 1 cent/kWh)	10,202	26.3
Public Water Works	1,387	3.6
Miscellaneous	1,014	2.4
Total	***38,837***	***100***

Strategy

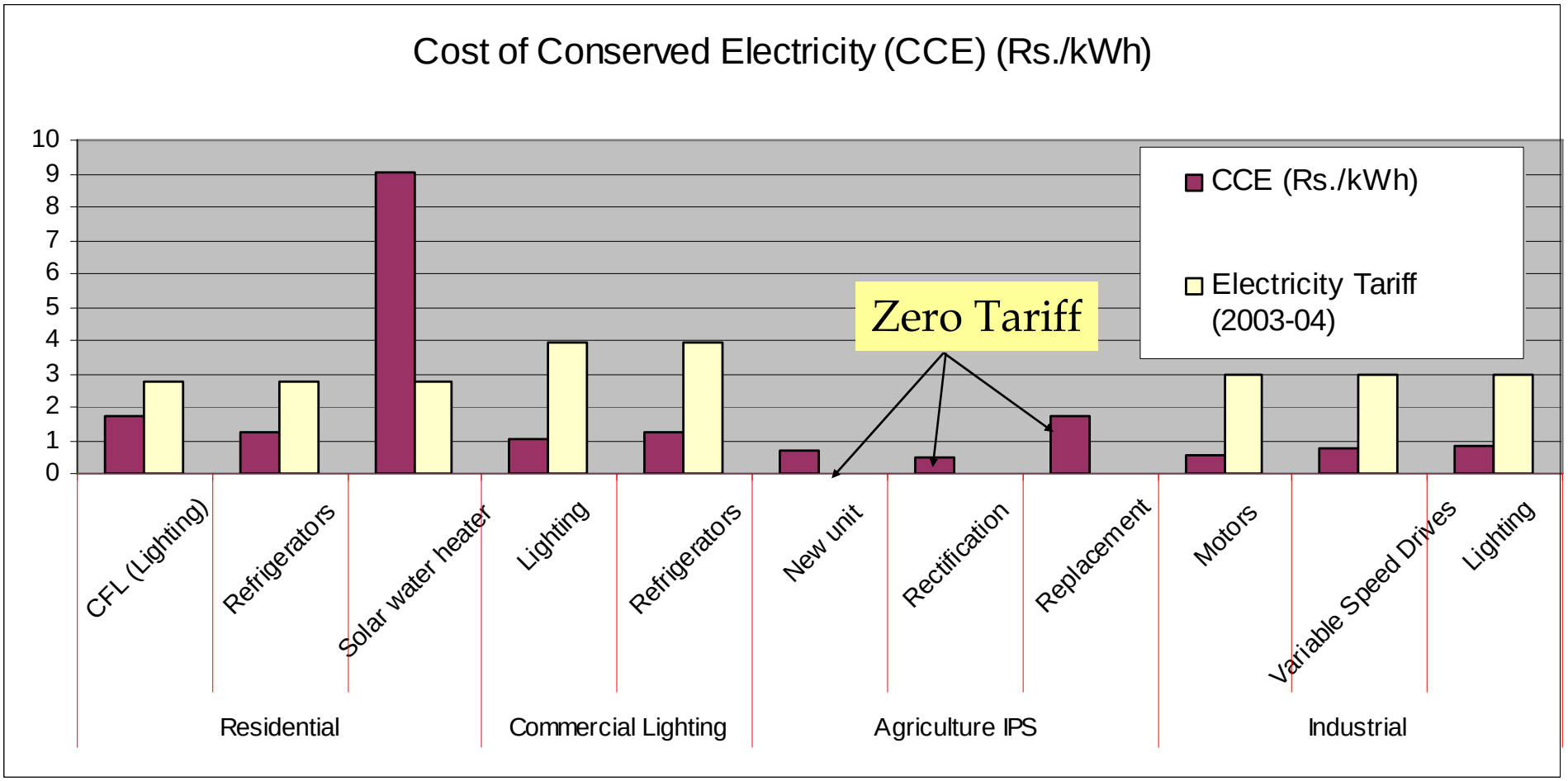
1. Reduce electricity consumption through implementation of cost-effective end-use efficiency (EE)
    1. **Non-shortage hours**: EE can reduce fuel and O&M costs – agricultural sector
    2. **On-shortage hours:** Saved electricity can be resold to unserved net-positive revenue customers – commercial and industrial sectors
2. **Estimate potential** for
    1. Electricity savings
    2. Reselling electricity to unserved customers

Potential for Reselling Electricity: Unserved Electricity Demand by MSEB Consumer Category

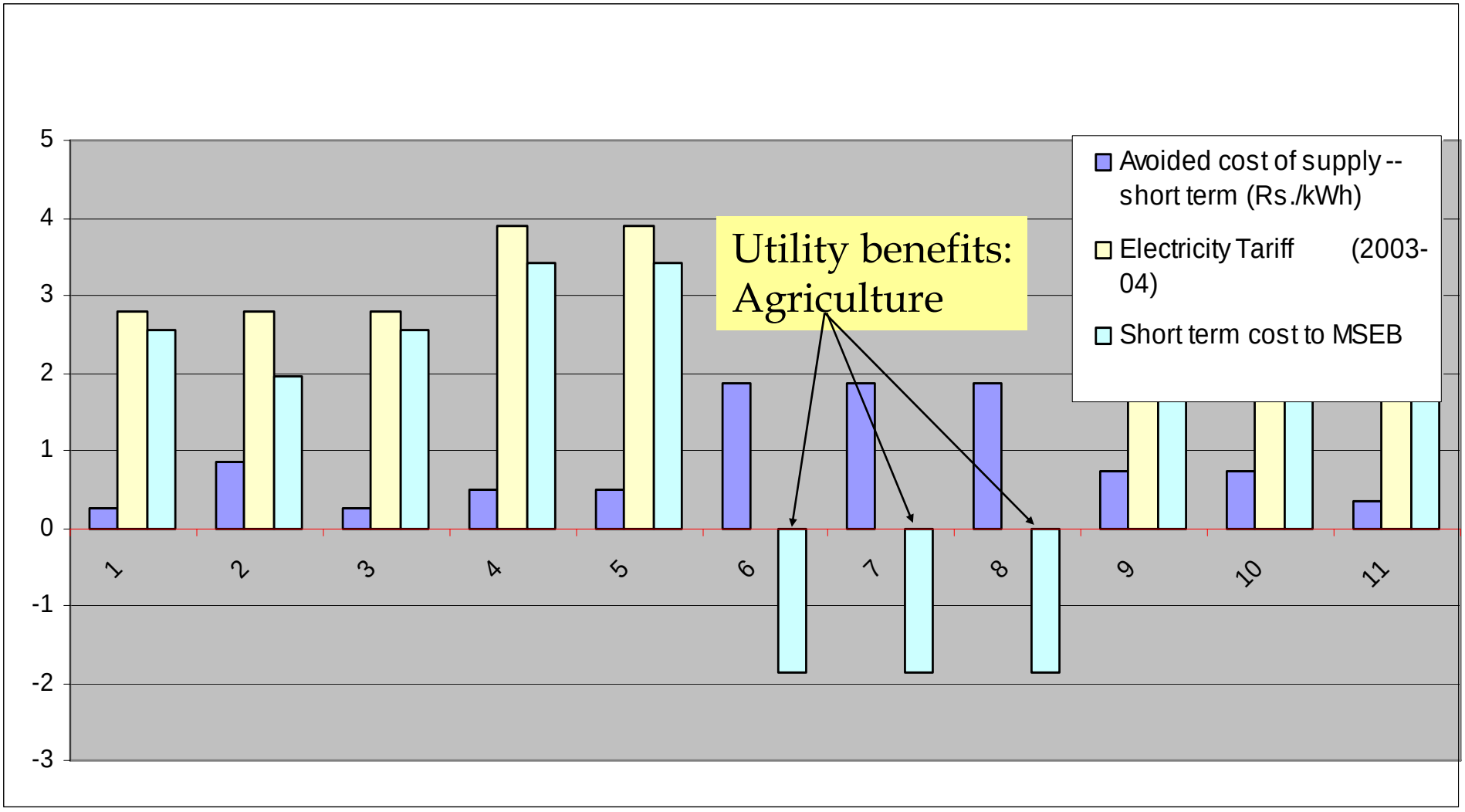
	Load shedding allocation 2002-03 (GWh)					
Consumer Category	**Urban (GWh)**	**(%)**	**Rural (GWh)**	**(%)**	**Total (GWh)**	**(%)**
Domestic	**594**	**41%**	**954**	**15%**	**1548**	**20%**
Commercial	**149**	**10%**	**157**	**2%**	**306**	**4%**
L. T. (non-MIDC)	**171**	**12%**	**254**	**4%**	**425**	**5%**
H. T. (non-MIDC)	**298**	**21%**	**860**	**13%**	**1159**	**15%**
Agri. & Irrigation	**87**	**6%**	**3620**	**57%**	**3708**	**47%**
Street lights	38	3%	101	2%	138	2%
Railway Traction	40	3%	53	1%	93	1%
Railway Non-Traction	7	0%	5	0%	11	0%
P.W.W.	37	3%	148	2%	185	2%
Military	15	1%	6	0%	21	0%
Mula Pravara	0	0%	241	4%	241	3%
Total	**1436**	**100%**	**6400**	**100%**	**7836**	**100%**

Total commercial and Low and High-Tension Industrial Customers – 1,890 GWh

Consumer Benefits: Cost of Conserved Electricity < Tariff



Utility Benefits: Only in the Agricultural Sector



Electricity End-use Efficiency Selected Measures:
Economic Benefit to MSEB – US$115 Mn./year

- End-use efficiency potential: 6,933 GWh
- Potential to raise MSEB revenue
  - On-shortage resale of residential and agricultural electricity savings to commercial and industrial consumers
    - **US $ 40 Mn./year**
  - Off-shortage avoided cost from agricultural sector EE improvement –
    - **US $ 75 Mn./year**

Economic Benefits to State Government

- **State government tax benefit:**
  - A kWh sold to business generates $0.20 direct state tax revenue
  - Industrial and commercial electricity shortage—1,922 GWh
  - Increased direct state tax revenue—$ 150-380 million depending on share of backup generation
  - Reduced state subsidy—$115 million
  - State revenue deficit—US $ 2.1 billion
  - Revenue increase and subsidy reduction together amount to 23% of revenue deficit
- **Employment increases in the business sector:**
  - Adds between 630 thousand and 1.6 million person-years of jobs
  - Including indirect impacts, these increase to 1.2 and 3.1 million person years respectively

Conclusions

- **Indian states face several challenges –**
  - **Growing electricity shortage, deteriorating utility finances, and fiscal deficits**
- **Energy efficiency can**
  - **Reduce MSEB shortage -- About 1300 MW and 6,900 GWh**
  - **Improve MSEB revenue -- About $ 80 million/year**
  - **Reduce government subsidy and increase sales tax revenue**
    - **Subsidy reduction -- $ 115 million per year**
    - **Increased sales tax revenue -- $ 150-350 million per year**
    - **Combined revenue increase**
      - **$ 275-515 million per year or about 13-25% of the state's revenue deficit**
    - **Including indirect impacts -- 21% and 43% of the revenue deficit**

Conclusions

- **Energy efficiency can**
  - **Increase employment in the business sector**
    - **Adds between 630 thousand and 1.6 million person-years of jobs**
    - **Including the indirect impacts, these increase to 1.2 and 3.1 million person years respectively**
- **Impact:**
  - **State regulatory commission ordered utility companies in Maharashtra to initiate a DSM program in residential lighting in Nashik District and Mumbai in 2005**

Economic Benefit to State Government

Reduction in Subsidy Payments US $115 Mn./year Can Offset Potential Agricultural Efficiency Program Costs – US $ 110 Mn.

	Subsidy Rate	Consumption targeted for efficiency improvement	Estimated Subsidy Amount	Efficiency Improvement potential	Subsidy Reduction Potential
	(cents/kWh)	(GWh/yr)	($ Million/yr)	(GWh)	($ Million/yr)
Agricultural	6	7,757	465	1,863	112
Residential	0.1	7,003	7	2,853	3
Total		14,760	472	4,716	**115**

Potential Agricultural Efficiency Program Capital Costs:

- Pump rectification, new efficient pumps, and pump replacement
- US $110 Million